



**UNIVERSITI PUTRA MALAYSIA**

**NON-LINEARITY IN MONETARY MODELS OF EXCHANGE RATE IN  
FIVE ASEAN COUNTRIES**

**LIEW KHIM SEN**

**FEP 2008 3**

**NON-LINEARITY IN MONETARY MODELS OF  
EXCHANGE RATE IN FIVE ASEAN COUNTRIES**

**LIEW KHIM SEN**

**DOCTOR OF PHILOSOPHY  
UNIVERSITI PUTRA MALAYSIA**

**2008**



**NON-LINEARITY IN MONETARY MODELS OF EXCHANGE RATE  
IN FIVE ASEAN COUNTRIES**

**By**

**LIEW KHIM SEN**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,  
in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

**February 2008**



*To*

*my mother Lai Hon Moi,*

*my wife Princess Joy Aguilar Tiamting,*

*my brothers and sisters,*

*for all their love, encouragement, help and support.*

*To*

*my nephews and nieces,*

*my sons Lorenz Phil Liew and Earl Justin Liew,*

*for all the joyful moment they have spent with me.*



Abstract of thesis presented to the Senate of University Putra Malaysia  
in the fulfilment of the requirement for the degree of Doctor of Philosophy

**NON-LINEARITY IN MONETARY MODELS OF EXCHANGE RATE  
IN FIVE ASEAN COUNTRIES**

**By**

**LIEW KHIM SEN**

**February 2008**

**Chairman: Ahmad Zubaidi Baharumshah, PhD**

**Faculty: Economics and Management**

This study is a part of the research endeavor since 1970s in searching for a satisfactory exchange rate forecasting model. The main objective is to evaluate the forecast performance of the relevant monetary exchange rate models, which are determined by the linear and non-linear approaches. Particularly, the long-run cointegration relationship between yen-based currencies of five major South East Asian countries including Indonesia, Malaysia, Singapore, Thailand and the Philippines (collectively known as ASEAN-5) and their fundamentals are investigated using the carefully designed testing procedures that include integration order, cointegration and exogeneity tests. The set of potential exchange rate determinants including domestic and Japanese money supplies, aggregate output levels, aggregate price levels and interest rates are included in this study. In this respect, several versions of monetary exchange rate models are considered. The lately developed non-linear stationary and non-linear cointegration tests are also employed aiming to provide complementary if not improvement to the robustness of

conventional tests. Towards the end of this study, the valid monetary exchange rate models are estimated for the ultimate purpose of forecast performance evaluation.

The major finding of this study is that both the purchasing power parity model and the reduced form forward-looking monetary model can have excellence predictive power for the dynamic behaviour of yen-based ASEAN-5 nominal exchange rates, over forecast horizon of 24 months or less, based non-linear smooth transition regression (STR) modeling procedures. Hence, this study is able to provide evidence to contradict the assertion that empirical exchange rate models have weak predictive power at horizons less than two years ([Lycons, 2002](#)). Importantly, the empirical forecasting performance of non-linear STR modeling procedures is for the first time revealed in this study.

Besides, this study identifies that, as far as ASEAN-5 is concern, current and past values domestic money supply, domestic aggregate output, Japan money supply, Japan aggregate output are the main driving forces of the current exchange rate dynamic, in addition to the past values of exchange rates. Furthermore, this study uncovers that rather than the long-perceived linear and symmetrical behavior, the nominal exchange rates adjust towards monetary fundamentals in a non-linear and asymmetrical fashions with respect to appreciation and depreciation of exchange rates, inflation and deflation, expansionary and contractionary monetary policy, as well as the economic cycles of both domestic and Japan countries. Taken together, these findings have important impacts on policy-decision and implementations as pointed out in the last chapter of this study.

Abstrak tesis yang dikemukakan kepada Senat University Putra Malaysia  
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**KETAKLINEARAN DALAM MODEL MONETARI UNTUK KADAR  
PERTUKARAN ASING DALAM LIMA NEGARA ASEAN**

**Oleh**

**LIEW KHIM SEN**

**February 2008**

**Pengerusi: Ahmad Zubaidi Baharumshah, PhD**

**Fakulti: Ekonomi dan Pengurusan**

Kajian ini merupakan sebahagian daripada usaha penyelidikan di dalam pencarian model ramalan kadar pertukaran asing yang memuaskan semenjak 1970an. Objektif utama kajian ini adalah untuk menilai prestasi ramalan model-model monetari kadar pertukaran asing, yang ditentukan dari perspektif linear dan tak linear. Khususnya, hubungan kointegrasi jangka panjang antara kadar pertukaran asing berdasarkan yen dan penentu-penentunya untuk lima negara utama Asian Tenggara iaitu Indonesia, Malaysia, Singapura, Negara Thai and Filipina (digelar ASEAN-5 keseluruhannya) dikaji dengan kaedah pengujian terpilih yang meliputi ujian peringkat integrasi, kointegrasi dan keeksogenan. Penentu kadar pertukaran asing yang berpotensi seperti penawaran wang, keluaran agregat, paras harga agregat dan kadar bunga domestic mahupun Jepun. Dalam kajian ini beberapa bentuk model monetari kadar pertukaran asing dipertimbangkan. Kaedah pengujian kepegunan dan kointegrasi yang terkini diguna sebagai ujian tambahan kepada ujian konvensional. Pada akhir kajian ini, model monetari kadar pertukaran asing yang didapati sah akan dianggarkan untuk tujuan muktamad iaitu penilaian prestasi ramalan.

Penemuan utama kajian ini ialah model kuasa keseimbangan beli dan model monetary berpandangan hadapan berbentuk termudah mempunyai kuasa ramalan yang unggul untuk kelakuan dinamik kadar pertukaran asing ASEAN-5 berasaskan yen, untuk jangka ramalan selama 24 bulan atau kurang daripadanya, berdasarkan kepada kaedah tak linear iaitu regresi peralihan licin. Dengan itu, kajian ini dapat menunjukkan bukti untuk menafikan pendapat bahawa model empirik pertukaran asing tidak mempunyai kuasa ramalan sama sekali untuk jangka ramalan dua tahun atau kurang (Lycons, 2002). Pentingnya, prestasi ramalan bagi kaedah regresi peralihan licin adalah pada julung kalinya diketahui melalui kajian ini.

Selain daripada itu, kajian ini mengecamkan bahawa bagi ASEAN-5, nilai kini dan lepas untuk penawaran wang dan keluaran agregat domestik dan Jepun merupakan kuasa utama yang mempengaruhi pergerakan dinamik kadar pertukaran asing kini, selain daripada nilai lepas kadar pertukaran asing itu sendiri. Tambahan pula, kajian ini mendapati bahawa kadar pertukaran asing nominal menyeleras terhadap asas monetari secara tak linear dan tak simitri, bukannya linear dan simitri yang selama ini dijangkakan, terhadap penambahan dan kesusutan nilai kadar pertukaran asing, inflasi dan deflasi, polisi monetari yang mengembang dan menyusut, dan juga kitaran ekonomi negara domestik mahupun Jepun. Secara keseluruhan, penemuan-penemuan kajian ini mendatangkan impak yang penting terhadap keputusan dan pelaksanaan polisi dan implementasi yang dikemukakan pada akhir bab kajian ini.



## ACKNOWLEDGEMENTS

After going through several years of hard time, this thesis is finally completed. Upon the completion, I would like to thank my main supervisor, Professor Dr. Ahmad Zubaidi Baharumshah, whose guidance and encouragement have benefited me the most. His persistent and untiring research spirit has a life-long influence on me. Thanks also to my co-supervisors Professor Dr. Muzafar Shah Habibullah and Associate Professor Dr. Habshah Midi for their insightful suggestions. The constructive comments from the examiners and the viva examination committee members are also gratefully acknowledged.

I am grateful to, among others, Professor Dr. Alan Wong, Dr. Choong Chee Keong, Dr. Evan Lau, Hamizah, Huzaimi Hussain, Jopesh Lai, Dr. Law Siong Hook, Lee Hock Ann, Liew Nyan Gong, Lim Kian Ping, Malcom Yap, Napsiah, Dr. Puah Chin Hong, Soo Chun Keat, Stephen Chai, Associate Professor Dr. Terence Chong, Professor Dr. Venkata Sessaiah, Voon Yong Seng, and Dr. Yusuf Ahmad, who have helped me in certain ways in various stages of my study. None of the individuals mentioned above is responsible for any error pertaining to this dissertation, that is mine and mine alone.

I would also like to acknowledge Universiti Putra Malaysia, Universiti Kebangsaan Malaysia, Universiti Malaya, Universiti Malaysia Sabah, The South East Asian Central Banks (SEACEN) and Malaysia Central Bank for their library and computer laboratory services.

I am unable to thank my dearest mother, brothers and sisters enough for their affection and support. I am also deeply indebted to my beloved wife for her warmest encouragement as well as unconditional sacrifices and cares. I thank all my nephews, nieces, and my little sons for teaching me the meaning of genuine happiness through all the joyful moment they have given me for nothing.

Finally, this thesis would have never been completed if my late father, Liew Tou Ngam had not inculcated me the spirit of assiduousness ever since I was a school boy. I forever owe his soul a debt of gratitude.

I certify that an Examination Committee has met on February 29, 2008 to conduct the final examination of Liew Khim Sen on his Doctor of Philosophy thesis entitled “Non-Linearity in Monetary Models of Exchange Rate in Five ASEAN Countries” in accordance with Universiti Putra Malaysia (Higher Degree) Act 1980 and Universiti Putra Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the degree of Doctor of Philosophy.

Members of the Examination Committee were as follows:

**Zaleha Mohd Nor, PhD**

Lecturer

Faculty of Economics and Management  
Universiti Putra Malaysia  
(Chairperson)

**Azali Mohamed, PhD**

Professor

Faculty of Economics and Management  
Universiti Putra Malaysia  
(Internal Examiner)

**Lee Chin, PhD**

Lecturer

Faculty of Economics and Management  
Universiti Putra Malaysia  
(Internal Examiner)

**Mohammed Yusoff, PhD**

Professor

Kulliyah Ekonomi dan Sains Pengurusan  
Universiti Islam Antarabangsa Malaysia  
(External Examiner)

---

**HASANAH MOHD GHAZALI, PhD**

Professor and Deputy Dean (Thesis)

School of Graduate Studies  
Universiti Putra Malaysia

Date: 28 April 2008

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

**Ahmad Zubaidi Baharunshah, PhD**

Professor  
Faculty of Economics and Management  
Universiti Putra Malaysia  
(Chairman)

**Muzafar Shah Habibullah, PhD**

Professor  
Faculty of Economics and Management  
Universiti Putra Malaysia  
(Member)

**Habshah Midi, PhD**

Associate Professor  
Faculty of Science and Environmental Studies  
Universiti Putra Malaysia  
(Member)

---

**AINI IDERIS, PhD**

Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date: 8 May 2008

## **DECLARATION**

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and it is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institution.

---

**LIEW KHIM SEN**

Date: 29 March 2008

## TABLE OF CONTENTS

Content	Page
<b>DEDICATION</b>	ii
<b>ABSTRACT</b>	iii
<b>ABSTRAK</b>	v
<b>ACKNOWLEDGEMENTS</b>	vii
<b>APPROVAL</b>	viii
<b>DECLARATION</b>	v
<b>LIST OF TABLES</b>	xiii
<b>LIST OF FIGURES</b>	xv
 <b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	1
1.1 A Brief History of Exchange Rates Development	4
1.2 An Overview of ASEAN-5 Exchange Rates	10
1.3 Motivation of Study: Failure of Fundamental Exchange Rate Models	19
1.4 Statement of Research Questions	23
1.5 Objectives of Study	24
1.6 Significance of Study	26
1.7 Organization of Study	29
 <b>2 LITERATURE REVIEW</b>	31
2.1 Fundamental Exchange Rate Models: Theoretical Analysis	32
2.2 Fundamental Exchange Rate Models: Empirical Evidence	41
2.3 Non-linearity of Exchange Rates: Rationales	60
2.4 Non-linearity of Exchange Rates: Empirical Evidence	64
2.5 Non-linear Stationary Property of Exchange Rates	69
2.6 Non-linear Cointegration between Exchange Rate and Fundamentals	87
2.7 The Bootstrap Method	97
2.8 Concluding Remarks	112
 <b>3 DATA AND METHODOLOGY</b>	114
3.1 Data of Study	117
3.2 Testing Strategy	120
3.3 Non-linear Cointegration Test	124
3.4 Non-linear Exogeneity Test	126
3.5 Linearity Test	130
3.6 Model Specification Test	133
3.7 Smooth Transition Regression (STR) Model	135
3.8 Modeling and Forecasting Procedures	147
3.9 Residual Diagnostics	149



3.10 Bootstrapping Procedures	150
3.10.1 Cointegration Test	150
3.10.2 Linearity Test	152
3.10.3 Model specification Test	153
3.11 Concluding Remarks	154
<b>4 FINDINGS AND DISCUSSIONS</b>	<b>155</b>
4.1 Integration Order	155
4.2 Cointegration	164
4.3 Exogeneity	174
4.4 Non-linearity	179
4.5 Non-linear Cointegration	185
4.6 Non-linear Exogeneity	188
4.7 Estimated Model	206
4.8 Forecasting	218
4.9 Concluding Remarks	228
<b>5 CONCLUSIONS</b>	<b>231</b>
5.1 Summary	246
5.2 Conclusion	247
5.3 Policy Implications of Study	247
5.4 Avenues for Further Research	251
<b>REFERENCES</b>	<b>253</b>
<b>APPENDIX</b>	<b>269</b>
<b>BIODATA OF STUDENT</b>	<b>275</b>

## LIST OF TABLES

Table	Page
3.1 Summary of Variables under Investigation	117
4.1 Results of Integration Order Test for Indonesia	157
4.2 Results of Integration Order Test for Japan	158
4.3 Results of Integration Order Test for Malaysia	160
4.4 Results of Integration Order Test for the Philippines	161
4.5 Results of Integration Order Test for Singapore	162
4.6 Results of Integration Order Test for Thailand	163
4.7 Results of Cointegration Tests for Model B	168
4.8 Results of Cointegration Tests for Model A	169
4.9 Results of Cointegration Tests for Model C	170
4.10 Results of Cointegration Tests for Model F	172
4.11 Results of Cointegration Tests for Model G	173
4.12 Results of Exogeneity Tests for Model A	176
4.13 Results of Exogeneity Tests for Model B	177
4.14 Results of Exogeneity Tests for Model G	178
4.15 Linearity Test on Exchange Rate and Fundamentals Relationship	180
4.16 Sequential Hypothesis Testing Results	183
4.17 Non-linear Cointegration Test Results	187
4.18 Estimated Transition Parameter	191
4.19 Non-linear Exogeneity Test Results for Model B	192
4.20 Non-linear Exogeneity Test Results for Model G	199
4.21 Estimated Results for Model B using OLS Procedure	207



4.22	Estimated Results for Model B using STR Procedure	210
4.23	Estimated Results for Model G using OLS Procedure	215
4.24	Estimated Results for Model G using STR Procedure	216
4.25	In-sample Forecast Performance by MAPE (Model B)	219
4.26	In-Sample Forecasting Performance Comparison by MAPE Ratio and $w$ Test (Model B)	220
4.27	Out-of-Sample Forecasting Performance by MAPE (Model B)	222
4.28	In-Sample Forecasting Performance Comparison by MAPE Ratio and $w$ Test (Model B)	223
4.29	In-sample Forecast Performance by MAPE (Model G)	224
4.30	In-Sample Forecasting Performance Comparison by MAPE Ratio and $w$ Test (Model G)	225
4.31	Out-of-Sample Forecasting Performance by MAPE (Model G)	226
4.32	In-Sample Forecasting Performance Comparison by MAPE Ratio and $w$ Test (Model G)	227



## LIST OF FIGURES

Figure	Page
3.1 Typical Exponential Transition Function	138
3.2 Typical Logistical Transition Function	144
3.3 Typical Exponential Transition Function against Time	145
3.4 Typical Logistical Transition Function against Time	146
4.1 Plot of Nominal INR/JPY Rate by Regime (Model B)	193
4.2 Plot of Nominal MYR/JPY Rate by Regime (Model B)	194
4.3 Plot of Nominal PHP/JPY Rate by Regime (Model B)	195
4.4 Plot of Nominal SGD/JPY Rate by Regime (Model B)	197
4.5 Plot of Nominal THB/JPY Rate by Regime (Model B)	198
4.6 Plot of Nominal SGD/JPY Rate by Regime (Model G)	200
4.7 Plot of Nominal MYR/JPY Rate by Regime (Model G)	201
4.8 Plot of Nominal THB/JPY Rate by Regime (Model G)	202
4.9 Plot of Nominal INR/JPY Rate by Regime (Model G)	203
4.10 Plot of Nominal PHP/JPY Rate by Regime (Model G)	204

# **CHAPTER 1**

## **INTRODUCTION**

Exchange rate plays a very significant role in domestic and international economics. It serves as the key mechanism that links the macroeconomics of an open domestic economy to the rest of the world. In particular, international macroeconomic linkages take place through the goods and assets markets with exchange rates serving as the channel of transmissions. Besides, exchange rate also provides link to international microeconomics via resource allocation in the goods and assets markets. In the former case, allocation of resources in factor market occurs through trade competitiveness in which resources are drawn into traded goods sector from the non-traded goods sector. Conversely, international funds are channeled to economy which provides higher rate of return on foreign capital investment plus the percentage change in the exchange rate of the foreign currency as compared to other economies.

Due to the importance of exchange rates in the international linkages, it is not difficult to see that the microeconomic efficiency and the macroeconomic stability of an open market economy to a large extent rest on the movement of exchange rates. Movements or changes in exchange rates may, among others, affect an economy's balance of payments, net capital flow, foreign reserves and even the effectiveness of government policy. Certainly, being able to foresee future exchange rate movement can be of great help to the economic growth of an economy. Hence, forecasting and monitoring exchange rates are vital to central bankers and government policy decision makers. Besides, exchange

rate forecasting can be extremely useful and has been extensively used in financial decision-making. Multinational corporations, for instance, require exchange rates forecasts both in the short-term and long-term because the sales, expenses, capital budgets, foreign investments, cash flows and the like for their operations in different countries, depend vitally on exchange rates. For international investors, the purchasing of foreign financial assets such as bonds and stocks involved foreign exchange risk as well since their net returns may shrink due to the downside exchange rate movement. For exporters and importers, international trade is very much dependent on exchange rates. Movements in exchange rates have significant impact on exports competitiveness. An appreciation of domestic currency or a depreciation of foreign currency may reduce export sales and therefore export revenue. For importers, depreciation in domestic currency or an appreciation in the foreign currency will increase the costs of imported goods and services. Sales may fall if they increase the selling prices, while profit margin may fall if they absorb the imported inflation. Thus, being able to forecast the exchange rates may help exporters and importers to enhance their trading activities and thereby profits. As for individuals, the budget for holiday of a traveler may vary when exchange rate changes. Even if you are staying at home, your choice of consumption and your living standard are very much affected by changes in exchange rates. Thus, understanding the past behavior of exchange rates and henceforth predicting the their future movements with satisfactory accuracy are crucial to international financial market participants such as central bankers, managers of multinational corporations and financial institutions, importers, exporters, foreign investors, speculators, arbitrageurs and even household units.

In general, it may be said that exchange rate forecasting is important because not only the current but also the future wealth of a nation, an organization or an individual will be affected by changes in exchange rates. Indeed, as a result of internationalization of business, liberalization of finance and trade as well as globalization of capital markets, coupled with the rapid advancement in the technology of money transfer, almost all issues on earth — the outlook of the world or domestic economy, the prospect of stock markets, the industrial competitiveness of a product or service, a firm or a country, the purchasing power of a consumer, the living standard of a citizen, ..., and even the outcome of the next general election — have to revolve around the exchange rates. Therefore, there is no element of surprise in the fact that modeling and forecasting of exchange rates has received widespread attention in the literature ever since the collapse of the Bretton Woods fixed exchange rate system in March 1973. However, it is noteworthy that after many decades of research, there is a general consensus that reliable exchange rate forecasting model hardly exist to date. Motivated by the utmost importance of exchange rate forecasting and the urgently hunted satisfactory exchange rate forecasts, this study is devoted to the continuous effort in the literature in searching for reliable exchange rate forecasting procedures with enthusiastic spirit.

The rest of this chapter is outlined as follows: Sections 1.1 and 1.2 present the background of this study by offering a brief history of exchange rates development in general as well as an overview of the exchange rates of the countries undertaken by this study respectively<sup>1</sup>. Section 1.3 discusses the motivation of this study whereas the

---

<sup>1</sup> Understanding the history of these exchange rates may provide us some useful intuitive in the modeling and forecasting of exchange rates.

problem statement and objectives of this study are clarified in Section 1.4 and Section 1.5 respectively. Section 1.6 describes the importance of this study and a sketch on the plan of this study is provided in Section 1.7.

## **1.1 A Brief History of Exchange Rates Development<sup>2</sup>**

Before the 20<sup>th</sup> century, most national currencies were backed by precious metal such as gold or silver although international transaction of currencies was not active yet. As transportation and storage technologies advanced resulting from industrial revolution, currencies transaction became more and more important because more and more transnational economic interactions and transactions were taking place. By 1930s, most major currencies had already been freely traded and were convertible into precious metal via the gold standard<sup>3</sup>.

In 1933, U.S. abandoned the gold standard, and the convertibility of Dollars into gold was suspended as a consequent of the Great Depression<sup>4</sup>. Many large economic powers were also forced to abandon the gold standard (due to the depletion of gold reserves to shore up military expenses) soon after Europe entered World War II (1937 – 1945) in 1939.

---

<sup>2</sup> This section is written based on [Copeland \(2005\)](#), [Moosa \(2005\)](#) and [Weithers \(2006\)](#), unless otherwise stated.

<sup>3</sup> Except Germany mark which was then no longer backed by gold. Mark had experienced tremendous depreciation (from 8 marks in 1919 fell to 4.2 trillion marks per USD in 1923) as a consequence of the hyperinflation (due to excessive expansion of money supply in Germany to consolidate reparations) resulting from World War I (1914 – 1919).

<sup>4</sup> With the world in the throes of the global depression, about one quarter of the U.S. work force was unemployed. In this period, money supply in U.S. fell significantly by one third from 1929 to 1933.

Towards the end of the war (July 1944), representatives from the Allied nations who gathered at Bretton Woods resolved to avoid the previous mistakes of past postwar settlements. Their main concerns were to reconstruct the European economies and prevent competitive devaluations and protectionism that had characterized the 1930s. The ultimate result of the meetings at the Bretton Woods Conference was the well-known Bretton Woods Agreement endorsed by the delegates of 44 countries. The most significant contribution of this agreement is the establishment of a fixed exchange rate system, known as the Bretton Woods System (1944 – 1968), in order to facilitate more stability to the new world economic order. Under this system, most of the major European currencies were pegged to the USD and the USD in turn was pegged to gold. The International Monetary Fund (IMF) was set up to police this fixed exchange rate system (and granting loans to deal with balance of payments difficulties), whereby the countries involved helped to maintain convertibility and to facilitate these pegs within a  $\pm 1\%$  bands. Periodic revaluations (new fixed rates or parities) were allowed with the permission of the IMF whenever obvious evidence of international trade imbalances appeared. The International Bank of Reconstruction and Development (later emerged as the World Bank), which specialized in granting loans for reconstruction and development and was also set up under this agreement.

The Bretton Woods System worked quite well for more than 2 decades, before its credibility was seriously challenged in the late 1960s. During this era, changes in the major parities were very few and relatively small in scale. However, in 1967, the British pound was attacked and the central bank intervention through currency market operations

failed for the first time, leading to a decline in the value of British pound. More acutely, in the following year, the USD was also weakened relative to other currencies resulting from the increasing money supply through printing press, in order to finance the Vietnam War, in which the U.S. was deeply involved. As U.S. anchored the system as a whole, the declination of USD coupled with the falling competitiveness of U.S. trade and the rising of the deutschmark and yen due to the recovery of economy (Germany and Japan, as trade surplus countries, resisted to revalue their currencies) eventually insolvent the fixed exchange rate system. In the late 1960s, national inflation rates began to diverge and inconsistencies and incompatible macroeconomic policies in the major industrial countries became increasingly obvious. The option for floating exchange rate appeared to be more and more appealing. The system finally broke down on 15 August 1971 when U.S. suspended gold convertibility. In mid-1972, Britain ceased to support the fixed parity by allowing market forces to determine the pound exchange rates. This was followed by Japan and Italy which allowed their currency to float soon after the dollar was devalued by 10% in February 1973.

By 1973, floating exchange rate era had effectively begun, when foreign exchange markets opened on 19 March. The floating exchange rate era, however, was only stable for the beginning until the mid-1970s. After that, floating rates then became extremely volatile, with massive short-term fluctuations and obvious yet persistent longer run misalignment (relative to fundamentals) of all the major currencies including the USD. The major features of the floating exchange rate era include the U.S. twin deficits by the

end of 1980s, two massive OPEC oil price hikes<sup>5</sup>, deepening of international debt crisis and global scale debt insolvency in the early 1980s, the world stock market crash in 1987, the rising of Japan in the mid-1980s as the world's largest trading nation and the declining role played by U.S. in the world markets, the rising of the other Asian economies<sup>6</sup> due to their spectacular blooming in the economic growth and overwhelming (overheated) stock market performance in the early to mid-1990s, and a series of exchange rate and stock market crashes in Asia in the 1997 - 1998. All in all, these features sum up to reveal that floating exchange rates have failed to deliver tranquility but instead have brought intolerable levels of volatility.

The world of free international capital movements brought about by technology advancement in electronic trading systems (Electronic Brokering System, introduced in 1993) does not favor the fixed exchange rate regime either. This could be obviously observed from the failure of European Monetary System (EMS) (1979 – 1993). EMS was established by European Economic Community (EEC) which realized the need to maintain for some stability in the European currencies relative to one another then. The member countries arranged the Exchange Rate Mechanism (ERM), in which the values of their currencies were fixed against one another, along with tight bands ( $\pm 2.25\%$  range, except lira,  $\pm 6\%$ ) of fluctuation, through the support of the European central banks. Effectively, the central exchange rate franc/deutschmark (other currencies were relatively minor) was kept stable by capital controls in France. ERM experienced few pressure

---

<sup>5</sup> One occurred in 1973-1974, which led to accelerated inflation, and another one happened in 1979, which led to a short sharp recession in U.S. and a more prolonged slump in Europe, and a steeply falling price in the 1980s.

<sup>6</sup> They were Hong Kong, Singapore, South Korea, Taiwan (collectively known as Asian Four Dragons), Malaysia, Indonesia, the Philippines, Thailand (Four Asian Tigers) and China.



since its establishment — worldwide recession that eventually led to the devaluations of franc from 1981 through 1983, the 25% devaluation of USD with respect to major European currencies in 1986, and the 1992 massive speculative pressure on (Quantum Fund of George Soros took a large short position in) the British pound and Italian lira<sup>7</sup>, and the burden of high interest rates of EMS countries due to rapidly growing budget deficits of Germany in the early 1990s — until French eventually gave up in defending the depreciation of franc against the German mark<sup>8</sup>, and henceforth the collapse of EMS in 1993. In 1993, the European Monetary Union (EMU), which had replaced EEC under the Maastricht Treaty in December 1991, widened the tight bands to  $\pm 15\%$ , rendering European currencies effectively floating.

Nevertheless, that was not the end of the story, because EMU was working towards transforming the European countries into a full monetary union with a single currency, since the 1991 Maastricht Treaty. Subsequently, the common currency, euro finally was introduced for trading (but not in physical form) on 1 January 1999 under the administration of the European Central Bank (ECB). Euro was introduced at a value of USD1.18 per euro and the other currencies<sup>9, 10</sup> were fixed irrevocably at one for one with respect to euro. Euro came into existence in physical form of notes and coins in January

---

<sup>7</sup> The attempt by Bank of England to defend the pound within the ERM prescribed band using, market intervention and interests was ineffective, lira suffered a similar fate.

<sup>8</sup> At that time, mark appreciated against other currencies due to upwards pressure on German interest rates to attract funds for reunification.

<sup>9</sup> Currencies of the 11 founding members: Germany, Italy, France, Spain, Portugal, Ireland, Belgium, Netherlands, Luxembourg, Austria and Finland.

<sup>10</sup> Greece, which was denied membership based on convergence criteria, later joined on the 1 January 2001. The other three EMU members, namely Denmark, Sweden and UK decided not to participate and were granted the right to temporally opt out of the union.